**Explaining Endothermic and Exothermic Reactions**

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| **1)a)** Explain When solid sodium hydroxide is added to water, the temperature increases.  **b)** The freezing of water to form ice can be represented by the following equation. H2O() → H2O(*s*)  **2 )a)** Dissolving ammonium nitrate in a beaker containing water can be represented by the following equation:  NH4NO3(*s*) → NH4+(*aq*) + NO3– (*aq*) Δr*H*° = 25.1 kJmol–1  Choose the term **(endothermic or exothermic)** that best describes this process.  Choose the phrase that best describes what you would observe happening to the beaker during this process (**gets colder, stays the same, gets warmer)**  Explain your choice.  **(b)** Glucose is an important source of energy in our diet. The equation below shows the combustion of glucose to form carbon dioxide and water.  C6H12O6(*s*) + 6O2(*g*) → 6CO2(*g*) + 6H2O(*ℓ*) Δr *H°* = *–*2 820 kJ mol–1  **(i)** Choose the term **(endothermic or** **exothermic)** that best describes this process. Give a reason for your choice.  **(ii)** Females who are moderately active need 9 800 kJ of energy per day. Calculate the number of moles of glucose that would provide this daily energy  requirement.  **(c)** Many portable BBQ and camping gas canisters contain butane, C4H10. Butane is a gas at room temperature, and has a boiling point of – 0.5°C. The gas canisters contain both gas and liquid butane. As the gaseous butane is used, some of the liquid evaporates.  Choose the term **(endothermic or** **exothermic)** that best describes this process.  Give a reason for your choice, and use your knowledge of structure and bonding, and energy changes, to explain the changes occurring as the liquid evaporates. |
| **3) a)** Some Bunsen burners use methane gas, CH4, as a fuel. The reaction for the combustion of methane in a Bunsen burner is shown in **Equation One Equation One**: CH4 + 2O2 → CO2 + 2H2O Δr*H* = –889 kJ mol–1  When this reaction occurs, bonds are broken and bonds are formed.  State which bonds are broken and which bonds are formed during the reaction  **b)** The equation for water boiling at 100°C is shown below in **Equation Two**. **Equation Two**: H2O(*ℓ*) → H2O(*g*) Δr*H* = 40.7 kJ mol–1  Explain why this equation is endothermic. You should relate the energy changes that are occurring to the specific bonds being broken or formed. |
| **4) a)** Ice melting to form water can be represented by the following equation: H2O(*s*) 🡪 H2O(*ℓ*)  State whether the reaction is Endothermic or Exothermic and give reasons for your choice  **b)** The reaction between hydrogen gas and oxygen gas to form water in the gaseous state can be represented by: 2H2(*g*) + O2(*g*) 🡪 2H2O(*g*)  When this reaction occurs, bonds are broken and bonds are formed. State which bonds are broken and which bonds are formed.  The bond breaking and bond forming processes above can be described as EITHER **exothermic** OR **endothermic**.  State which process is exothermic and which process is endothermic and Explain your answer. |
| **5) a)** For the reaction 4NH3(*g*) + 5O2(*g*) 🡪 4NO(*g*) + 6H2O(*g*), the enthalpy of reaction is Δr*H* = –950 kJ mol–1.  The reverse reaction is 4NO(*g*) + 6H2O(*g*) 🡪 4NH3(*g*) + 5O2(*g*)  Two energy diagrams are shown below. One is for the forward reaction and one is for the same reaction in the reverse direction.   |  |  | | --- | --- | | 1.jpg | 2.jpg |   **i)** For each diagram, indicate whether the diagram is for an exothermic reaction or an endothermic reaction  **ii)** For each diagram, indicate whether the diagram is for a forward or reverse reaction  **iii)** On the diagrams for both reactions, also label the following:  • enthalpy of reaction, Δr*H*  • Activation Energy, *E*a.  **iv)** Determine the value for the enthalpy of reaction (Δr*H* ) for the reaction shown in Diagram Two. Explain how you determined this value. | |

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